

## MAORIS: A WORD PUZZLE

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A new kind of magic square has recently been discovered and our puzzle MAORIS is a realization in words of the 4x4 case. In addition, MAORIS can be played effectively as a two-person board game that has a rather subtle forced win for one of the combatants.

We require a 4x4 grid (the corner of a checkerboard will do) and twelve tiles on which are printed the words AI (the three-toed sloth), AS, IO (one of the Galilean moons of Jupiter), IS, MA, MR, MS, OM (a Hindu mantra), OR, RA (the Egyptian sun god), RI (a Japanese measure of 2.44 miles), and SO. Notice that the twelve two-letter words use each of the letters of MAORIS exactly four times so that the puzzle pieces have complete symmetry and, hence, none is more special than another. This trait often makes puzzles and games harder to solve.

The object of the puzzle is to arrange the twelve words on the 3x3 grid so that each row and each column contains all six letters of the word MAORIS. This feat is not so easy to accomplish, even though there are 1152 solutions that will look different to the eye. Of course there will have to be exactly one empty grid square in each row and each column to accommodate the fact that the six letters occur in pairs on exactly three tiles. This usually adds to the confusion of the solver.

Any of the solutions will form a magic square on the rows and columns (it is not possible to include the diagonals) with magic constant MAORIS. See the article "Magic Square Magic" in the May 2000 Word Ways for more details about magic squares with words. Each of the 1152 solutions can be transformed into any other by a sequence of row and/or column interchanges with perhaps one reflection about the main diagonal. Thus, up to interchanges and reflections there is only one solution to the puzzle. A generic solution is given in Answers and Solutions.

The two-person game may be played in several different versions. For the standard game the tiles are placed on the table face up for the use of either player. First places any tile anywhere on the grid. Second then places another tile with the proviso that it cannot be placed in a row or column with First's choice if the tiles have a letter in common. The turns alternate until someone cannot place a tile and loses. Second can always win this game but we leave the analysis to the reader.

For another variation, mix the twelve tiles face down and allow the two players to each select a hand of four tiles. Play proceeds as before until someone is first able to place all of his tiles and wins. First has a slight edge in this version.

The astute reader will notice that certain letters do not occur together in any word. These tabu pairs are A-O, I-M and R-S. Visualize a cube with these letter-pairs on opposite faces. It is then clear that our twelve words are the twelve edges of the cube, labeled by abutting faces. This procedure can be generalized to hypercubes of all dimensions, but it is difficult to realize these constructions as word games.